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## CAUSE AND PREVENTION OF BLUE STAIN IN WOOD

Blue stain is caused by fungi that grow in sapwood and use parts of it for their food. It is not a stage of decay, although the conditions that favor blue staining also very often lead to infection with decay-producing fungi. Excepting toughness, blue stain has little effect on the strength of wood.

To prevent blue stain it is necessary to produce conditions unfavorable to the development of the causal fungi. These fungi are disseminated either by spores, which are produced in great abundance and are carried about by wind and insects, or by direct growth from infected to uninfected wood. Their growth is dependent upon proper food, moisture, air, and favorable temperatures. If any one of these factors can be rendered inadequate or unfavorable, sapwood will not stain.

The wood can be made unsuitable as food for fungi by introducing chemicals into it that are toxic to the fungi. This method of controlling stain in green lumber is used widely. The blue-stain fungi cannot grow in wood which has a moisture content of less than 20 percent nor in wood in which the cell cavities are absolutely full of water. Hence, stain can be prevented either by rapidly drying freshly exposed surfaces to a moisture content below 20 percent or by keeping the stock submerged in water. Blue-stain fungi grow most rapidly when the temperature is from 75° to 85° F. If the temperature of the wood is below 35° F. or above 100° F., no stain is likely to take place.

### Controlling Blue Stain in Logs

Logs are often badly infected before they are sawed into lumber. Where immediate conversion of logs into lumber or immediate storage of logs in water is impossible, a practicable method of controlling stain is provided by chemical treatment if insect infestations are not severe.

### Chemical Treatments

Spraying the ends and barkless areas of freshly cut logs with the following chemicals will substantially retard the occurrence of blue stain in hardwoods during storage periods as long as 3 months. With the exception of borax, the same treatments are suitable for softwood logs, but they may not give adequate protection for so long a period as with hardwoods.

The antiseptic can be applied with an ordinary garden spray. In warm weather, treatment should not be delayed longer than 24 hours after the trees are felled. In northern winter climates a delay as long as several weeks may be tolerated.

To control stain in timber species in which end checking is likely to be prevalent during the warm-weather period of storage, a moisture-resistant end coating should be applied after the spray treatment. Heavy asphaltic preparations serve well for this purpose.

Trade names of commercial products that can be used to make up water solutions for treatment of logs are, in alphabetical order:

Diprite<sup>1</sup> Lignasan<sup>3</sup> Napclor<sup>2</sup> Permatox 10-S<sup>2</sup> Santobrite S<sup>1</sup>  
Dowicide G<sup>2</sup> Melsan<sup>3</sup> Noxtane<sup>4</sup> Santobrite<sup>5</sup> Timber San<sup>6</sup>

The concentration of these materials, in most cases, should be about three times that recommended by the supplier for ordinary use on lumber to be air seasoned.

For spraying frozen logs, an oil solution should be used. A suitable one can be made up with 5 gallons of 1:10 concentrate of pentachlorophenol in 100 gallons of No. 2 fuel oil. Pentachlorophenol concentrate can be obtained from several companies.<sup>2, 4, 5, 6</sup>

Insects can be controlled by thoroughly spraying the sides, as well as the ends, of the logs with a solution containing 32 pounds of emulsifiable concentrate of benzene hexachloride (containing 11 percent of gamma isomer) in 100 gallons of No. 2 fuel oil. If it is desired to use both an antiseptic chemical and the benzene hexachloride insecticide, the two can be combined in a single spray solution. The antiseptic in this case should be pentachlorophenol. The concentrations of the two chemicals should be the same as recommended for their use individually.

All chemical compounds mentioned are regarded as poisonous. Be sure to read the caution given in this Technical Note under the heading, "Precautions," before attempting to use these compounds.

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<sup>1</sup>Vanderbilt Co., Inc., New York, N. Y.

<sup>2</sup>Chapman Chemical Co., Memphis, Tenn.

<sup>3</sup>E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

<sup>4</sup>Wood Treating Chemicals Co., St. Louis, Mo.

<sup>5</sup>Monsanto Chemical Co., St. Louis, Mo.

<sup>6</sup>Timber Products Chemical Co., Minneapolis, Minn.

## Controlling Blue Stain in Lumber and Timbers

The most effective method of preventing stain in lumber is to kiln dry the stock green from the saw. By this method moisture conditions are rapidly made unfavorable for the growth of fungi. Stock to be air seasoned can be protected against staining by treating the surfaces with chemicals that stop the development of the stain fungi or by employing special piling methods, such as end racking or crib piling, that shorten the time required to dry the surfaces to a moisture content unfavorable for the growth of the fungi. Chemical treatment is cheaper and more effective because it is less dependent on weather conditions, and, when it is followed by flat piling, the stock dries with less warping and twisting. Chemical treatment also is particularly useful for the temporary protection of green timbers.

Chemical Treatment of lumber is usually accomplished by dipping, either mechanically or by hand, depending largely on the output of the mill. At some mills the chemical is sprayed on the lumber, but this procedure is most commonly used in treating timbers and dimension items that cannot conveniently be handled in an ordinary dipping vat.

Preparations most commonly employed for use on lumber and timbers are the same as those listed for log treatments. However, the concentrations needed are about one-third those used on logs. For maximum effectiveness and safety in handling, directions furnished by the distributors should be carefully followed. For stock thicker than 2 inches and timbers, and for stock that is to be solid piled temporarily or seasoned in poor drying weather, the solution concentration may advantageously be increased to 1-1/2 to 2 times the normal amount.

In addition to the proprietary chemicals, borax at the rate of 30 pounds per 100 gallons of water can be used effectively on hardwood lumber, but not on pine.

### Precautions

For satisfactory results with any dipping or spraying treatment, careful consideration should be given to the following:

- (1) Stain-free logs. Surface treatment of boards from infected logs will not stop the development of fungi already present.
- (2) Prompt treatment. Treatment preferably should not be delayed longer than 24 hours after sawing; delays are frequently responsible for interior stain.

(3) Thorough coverage of the stock. Sufficient attention should be given to the quantity of dipping solution, or the condition of the spray nozzles, to insure complete wetting of the surfaces at all times.

(4) Adequate concentration of the chemical. Solution concentrations should never be lower than those recommended, but during unfavorable weather they sometimes can be increased to advantage.

(5) Protection of the treating solution and treated stock from rain.

(6) Good seasoning practices. The treated stock should be piled so that it will dry as rapidly as possible without undue warping or checking. Yard piles should be as narrow as practical, properly elevated, well spaced, and adequately roofed. The use of stock boards as stickers, especially those over 4 inches wide, increases the likelihood of sticker stain. Narrow, dry stickers are greatly to be preferred. Chemically treated stickers last longer than untreated ones and are less likely to carry infection to the lumber.

(7) Care in handling chemicals. All of the chemicals mentioned are regarded as poisonous. However, with reasonable care they can be used without known danger. Persons whose skin is found to be particularly sensitive to the chemical being used should avoid it entirely. In any case the chemicals, with the exception of borax, should not be permitted to get on the skin more than necessary, and not at all until they are fully diluted. For hand dipping and handling of the lumber immediately after dipping, waterproof aprons and rubber gloves are advised.

#### Chemical Treatment of Miscellaneous Wood Products

Antistain chemicals can be applied advantageously to a number of materials other than logs and lumber. Their use can be extended to green posts, veneer, hoop stock, shingles, lath, and similar products as a means of keeping them bright during seasoning.

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#### Protection of Dry Wood



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Seasoned wood again becomes susceptible to staining upon wetting; consequently, it must be kept in a reasonably dry condition (20 percent moisture content or less) if discoloration is to be avoided. Surface applications of chemicals for stain control during air seasoning provide no permanent protection. Chemical treatments are effective for long periods only when they are made to penetrate deeply into the wood, as in properly pressure-treated wood.